Scalable Lunar Surface Networks and Adaptive Orbit Access, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

Innovative network architecture, protocols, and algorithms are proposed for both lunar surface networks and orbit access networks. Firstly, an overlaying architecture is proposed to seamlessly integrate lunar surface networks and orbit access networks. Secondly, for lunar surface networks, a network architecture based on hybrid mesh networking technologies is developed to support both fixed and mobile nodes on the lunar surface. It supports autonomous network coverage extension via ad hoc networking capability. Link adaptation algorithms provide automatic link configuration and ensure constant high link quality in a dynamic harsh environment. To support QoS of heterogeneous traffic types, a QoS oriented MAC protocol with scalable throughput performance is proposed. A hybrid routing protocol is also proposed to enhance routing efficiency and dramatically improve the reliability of ad hoc networking. Thirdly, for orbit access networks, a dynamic delay and disruption-tolerant networking (DTN) routing protocol is designed by integrating DTN and mobile ad hoc network (MANET) reactive routing. It is disruption tolerant and capable of supporting intermittent links. Finally, beacon based communications serve as the remedy to handle the emergent situation where neither lunar surface network nor orbit access is available.

Anticipated Benefits

The same technologies can be adapted to DoD applications. For example, a communication network formed by both planes and ground battling units is similar to the integrated system of lunar surface networks and orbit access. On the non-government market, the most promising application areas will be IEEE 802.11 mesh networks, IEEE 802.16 mesh networks, and their integrated systems. The technologies will draw tremendous attentions from service providers, chipset companies, and networking software companies. The hierarchical architecture and routing protocol for IEEE 802.11 and 802.16 mesh networks will provide viable solutions for service providers to deploy cost-effective and reliable wireless mesh networks. The dynamic DTN routing protocol will also find good applications in system integration between satellite communications and wireless mesh networks.

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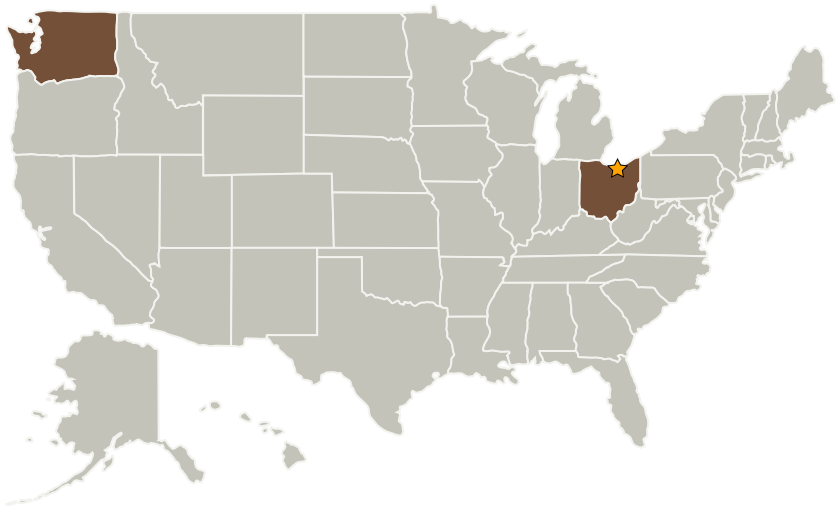
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Teranovi Technologies	Supporting Organization	Industry	Kirkland, Washington

Primary U.S. Work Locations	
Ohio	Washington

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

William D Ivancic

Principal Investigator:

Xudong Wang

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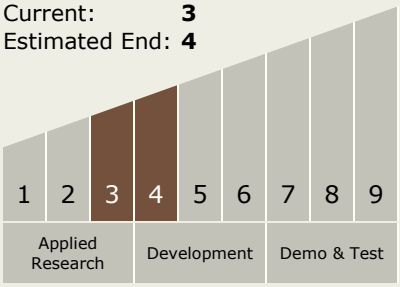
Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.3 Internetworking
    - TX05.3.2 Adaptive Network Topology